FORM PTO-1390 (REV. 9-2001) U.S. DEPARTMENT OF COMMERCE PATENT AND TRADEMARK OFFICE

TRANSMITTAL LETTER TO THE UNITED STATES DESIGNATED/ELECTED OFFICE (DO/EO/US) CONCERNING A FILING UNDER 35 U.S.C. 371

ATTORNEY 'S DOCKET NUMBER: ANRUK01000US0

U.S. APPLICATION NO. (If known, see 37 CFR 1.5): Unassigned 10/018549

INTERNATIONAL APPLICATION NO.	INTERNATIONAL FILING DATE	PRIORITY DATE CLAIMED
PCT/GB00/02267	12 June 2000 (12.06.00)	14 June 1999 (14.06.99)

TITLE OF INVENTION: APPARATUS FOR TESTING MOBILE PHONES

APPLICANT(S) FOR DO/EO/US: LEE, Michael John

Applicant herewith submits to the United States Designated/Elected Office (DO/EO/US) the following items and other information:

1. [X] This is a **FIRST** submission of items concerning a filing under 35 U.S.C. 371.
2. [ ] This is a **SECOND** or **SUBSEQUENT** submission of items concerning a filing under 35 U.S.C. 371.
3. [ ] This is an express request to begin national examination procedures (35 U.S.C. 371(f)). The submission must include items (5), (6), (9) and (21) indicated below.
4. [ ] The US has been elected by the expiration of 19 months from the priority date (Article 31).
5. [X] A copy of the International Application as filed (35 U.S.C. 371(c)(2))
   a. [X] is attached hereto (required only if not communicated by the International Bureau).
   b. [ ] has been communicated by the International Bureau.
   c. [ ] is not required, as the application was filed in the United States Receiving Office (RO/US).
6. [ ] An English language translation of the International Application as filed (35 U.S.C. 371(c)(2)).
   a. [ ] is attached hereto.
   b. [ ] has been previously submitted under 35 U.S.C. 154(d)(4).
7. [ ] Amendments to the claims of the International Aplication under PCT Article 19 (35 U.S.C. 371(c)(3))
   a. [ ] are attached hereto (required only if not communicated by the International Bureau).
   b. [ ] have been communicated by the International Bureau.
   c. [ ] have not been made; however, the time limit for making such amendments has NOT expired.
   d. [ ] have not been made and will not be made.
8. [ ] An English language translation of the amendments to the claims under PCT Article 19 (35 U.S.C. 371 (c)(3)).
9. [ ] An oath or declaration of the inventor(s) (35 U.S.C. 371(c)(4)).
10. [ ] An English lanugage translation of the annexes of the International Preliminary Examination Report under PCT Article 36 (35 U.S.C. 371(c)(5)).

Items 11 to 20 below concern document(s) or information included:

11. [ ] An Information Disclosure Statement under 37 CFR 1.97 and 1.98.
12. [ ] An assignment document for recording. A separate cover sheet in compliance with 37 CFR 3.28 and 3.31 is included.
13. [ ] A FIRST preliminary amendment.
14. [ ] A SECOND or SUBSEQUENT preliminary amendment.
15. [ ] A substitute specification.
16. [ ] A change of power of attorney and/or address letter.
17. [ ] A computer-readable form of the sequence listing in accordance with PCT Rule 13ter.2 and 35 U.S.C. 1.821 - 1.825.
18. [ ] A second copy of the published international application under 35 U.S.C. 154(d)(4).
19. [ ] A second copy of the English language translation of the international application under 35 U.S.C. 154(d)(4).
20. [X] Other items or information:
    Preliminary Amendment;
    Unsigned Declaration;
    Post card

EL 661 695 705 US

JC07 Rec'd PCT/PTO 14 DEC 2001

U.S. APPLICATION NO. (if known, see 37 CFR 1.5)	INTERNATIONAL APPLICATION NO.	ATTORNEY'S DOCKET NUMBER
10/018549	PCT/GB00/02267	ANRUK01000US0

21. [X] The following fees are submitted:

	CALCULATIONS PTO USE ONLY	
BASIC NATIONAL FEE (37 CFR 1.492 (a) (1) - (5)):		
Neither international preliminary examination fee (37 CFR 1.482) nor international search fee (37 CFR 1.445(a)(2)) paid to USPTO and International Search Report not prepared by the EPO or JPO **$1040.00**		
International preliminary examination fee (37 CFR 1.482) not paid to USPTO but International Search Report prepared by the EPO or JPO **$890.00**		
International preliminary examination fee (37 CFR 1.482) not paid to USPTO but international search fee (37 CFR 1.445(a)(2)) paid to USPTO **$740.00**		
International preliminary examination fee (37 CFR 1.482) paid to USPTO but all claims did not satisfy provisions of PCT Article 33(1)-(4) **$710.00**		
International preliminary examination fee (37 CFR 1.482) paid to USPTO and all claims satisfied provisions of PCT Article 33(1)-(4) **$100.00**		
ENTER APPROPRIATE BASIC FEE AMOUNT =	$ 890.00	
Surcharge of **$130.00** for furnishing the oath or declaration later than ☐ 20 ☒ 30 months from the earliest claimed priority date (37 CFR 1.492(e)).	$ 130.00	

CLAIMS	NUMBER FILED	NUMBER EXTRA	RATE		
Total claims	- 20 =		x **$18.00**	$ 0	
Independent claims	- 3 =		x **$84.00**	$ 0	
MULTIPLE DEPENDENT CLAIM(S) (if applicable)			+ **$280.00**	$ 0	
TOTAL OF ABOVE CALCULATIONS =				$ 1,020.00	
☐ Applicant claims small entity status. See 37 CFR 1.27. The fees indicated above are reduced by 1/2. +				$	
SUBTOTAL =				$ 1,020.00	
Processing fee of **$130.00** for furnishing the English translation later than ☐ 20 ☐ 30 months from the earliest claimed priority date (37 CFR 1.492(f)).				$	
TOTAL NATIONAL FEE =				$ 1,020.00	
Fee for recording the enclosed assignment (37 CFR 1.21(h)). The assignment must be accompanied by an appropriate cover sheet (37 CFR 3.28, 3.31). **$40.00** per property +				$	
TOTAL FEES ENCLOSED =				$ 1,020.00	
				Amount to be refunded:	$
				charged:	$ 1,020.00

a. [X] A check in the amount of $ 1,020.00 to cover the above fees is enclosed.

b. ☐ Please charge my Deposit Account No. _____ in the amount of $ _____ to cover the above fees. A duplicate copy of this sheet is enclosed.

c. [X] The Commissioner is hereby authorized to charge any additional fees which may be required, or credit any overpayment to Deposit Account No. 06-1325 . A duplicate copy of this sheet is enclosed.

d. ☐ Fees are to be charged to a credit card. **WARNING:** Information on this form may become public. **Credit card information should not be included on this form.** Provide credit card information and authorization on PTO-2038.

NOTE: Where an appropriate time limit under 37 CFR 1.494 or 1.495 has not been met, a petition to revive (37 CFR 1.137 (a) or (b)) must be filed and granted to restore the application to pending status.

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EL 661 695 705 US

IN THE UNITED STATES PATENT AND TRADEMARK OFFICE

In re Application Inventor(s):	Michael John Lee
SC/Serial No.:	Unassigned
Filed:	Herewith
PCT Application No.:	PCT/GB00/02267
Filed:	June 12, 2000
Title:	APPARATUS FOR TESTING MOBILE PHONES

PATENT APPLICATION

Customer No. 23910

PRELIMINARY AMENDMENT

Commissioner of Patents
Washington, D.C. 20231

Sir:

Prior to examination, and prior to calculation of the filing fee for this application, please replace claims 1-17 with claims 1-17 shown below. Marked up copies of amended claims illustrating the changes are shown in the Appendix to this Preliminary Amendment.

1. An apparatus for testing a radio apparatus of a type which receives a radio frequency (RF) signal from a RF signal generator and sends a RF signal to a receiver to modify the characteristics of the RF signal transmitted by said signal generator, said apparatus comprising:

an RF signal generator (122) for transmitting an RF signal (RF10) to said radio apparatus (127), and means to receive an input digital signal (DSIG10), which signal generator (122) controls the characteristics of the RF signal (RF10) transmitted in accordance with the input digital signal (DSIG10);

an RF receiver (122) for transmitting an RF signal (RF10) to said radio apparatus (127), and means to receive an input digital signal (DSIG10), which signal generator (122) controls the characteristics of the RF signal (RF10) transmitted in accordance with the input digital signal (DSIG10);

an RF receiver (129) for receiving an RF signal (RF11) from said radio apparatus (127), said RF receiver (129) including means to generate an output digital signal (DSIG12,DSIG15) having characteristics dependent on the characteristics of the RF signal (RF11) received;

a digital signal generator (102) for generating and outputting a digital signal (DSIG3);

signal modifying menas (111,112) connected to receive said digital signal (DSIG3) from said digital signal generator (102) and to receive said digital signal (DSIG14, DSIG15) from said RF receiver (129) whereby to modify said digital signal (DSIG3) from said digital signal generator (102) in accordance with said digital signal (DSIG14,DSIG15) from said RF receiver to thereby output a first modified digital signal (DSIG11, DSIG12) to provide the basis of said digital signal (DSIG10) input to said RF signal generator (122).

2. Apparatus as claimed in claim 1 in which said radio apparatus comprises a cellular phone.

3. (Amended) As claimed in claim 1 in which there is provided a second digital signal generator (100, 103) for generating and outputting a digital signal (DSIG1, DSIG2), second signal modifying means (105, 107) being connected to receive the digital signal (DSIG, DSIG2) from said second digital signal generator (100,103) and connected to receive said first modified digital signal (DSIG11, DSIG12) from said first signal modifying means (111,112) whereby to modify said first modified digital signal (DSIG11, DSIG12) in accordance with said digital signal (DSIG1, DSIG2) from said second digital signal generator (100, 103) to thereby output a second modifies digital signal (DSIG4, DSIG5) to provide the basis of said digital signal (DSIG10) input to said RF signal generator (122).

4. Apparatus as claimed in claim 3 including a digital fading simulator (112, 116), connected to receive said second modified digital signal, the output (DSIG, DSIG7) of the digital fading simulator comprising the second modified digital signal (DSIG4, DSIG5) the characteristics of which have been modified.

5. Apparatus as claimed in claim 4 in which said digital fading simulator includes means to change at least one of said digital signal elements of said second modified digital signal (DSIG4, DSIG5) to thereby change the phase or amplitude or delay of the RF signal (RF10) transmitted by said RF signal generator (122).

6. (Amended) Apparatus as claimed in claim 5 in which the fading simulator includes means to vary one or more of said digital signal elements in accordance with a predetermined pattern with respect to time.

7. (Amended) Apparatus as claimed claim 1 in which the or each digital signal generator outputs a digital signal including digital signal elements relating to one or more of phase, amplitude, and delay in respect of the resultant RF signal (RF10) transmitted by the RF signal generator (122).

8. (Amended) Apparatus as claimed in claim 1 in which said RF receiver (129) includes means to generate two output digital signals (DSIG14, DSIG15) having characteristics based on different characteristics of the RF signal (RFII) received by the receiver (129), and there are provided a second and third digital signal generators (100, 103) which output respective digital signals (DSIG1, DSIG2), said signal modifying means (111, 112) comprising firs and second signal modifying means (111,112) connected to respectively receive a digital signal (DSIG3) from said first digital signal generator (102) and to receive a respective digital signal (DSIG14, DSIG15) from said RF receiver (129) whereby to modify said digital signal (DSIG3) from said first digital signal generator (102) in accordance with said digital signal (DSIG14, DSIG15) from said RF receiver to thereby output a respective first and second modified signal (DSIG11, DSIG12), third and fourth signal modifying means (105, 107) connected to receive a digital signal (DSIG1, DSIG2) from a respective one of the second or third digital signal generators (100,103) and connected to receive said digital signal (DSIG11, DSIG12) from a respective one of said first or second signal modifying means 111, 112 whereby to modify the respective modified digital signal (DSIG11, DSIG12) in accordance with said digital signal (DSIG1, DSIG2) from the relevant second or third digital signal generator (100, 103) and to thereby output third and fourth modified digital signals (DSIG4, DSIG5), a combination of digital signals derived from said third and fourth modified signals (DSIG4, DSIG5) providing said digital signal input to said RF signal generator (122).

9. Apparatus as claimed in claim 8 including:

a first digital fading simulator (116), connected to receive said third modified digital signal (DSIG4), the output (DSIG6) of the first digital fading simulator (116) comprising a fifth modified digital signal (DSIG6) the characteristics of which have been modified by said first digital fading simulator;

a second digital fading simulator (112), connected to receive said fourth modified digital signal (DSIG5), the output (DSIG6) of the second digital fading simulator (116) comprising a sixth modified digital signal (DSIG7) the characteristics of which have been modified by said second digital fading simulator; and

a digital signal combines means (119) to combine said fifth and sixth digital signal to provide a seventh digital signal (DSIG8).

10. Apparatus as claimed in claim 9 in which each digital fading simulator (116, 112) includes means to change at least one of said digital signal elements of said third or fourth modified digital signal (DSIG4, DSIG5) to thereby change the phase or amplitude or delay of the RF signal (RF10) transmitted by said RF signal generator (122).

11. Apparatus as claimed in claim 10 in which each digital fading simulator (116, 112) includes means to vary one or more of said digital signal elements in accordance with a predetermined pattern with respect to time.

12. (Amended) Apparatus as claimed in claim 1 in which it is provided a white noise digital signal generator (124), the digital output signal DSIG9 of said white noise digital signal generator being applied to the digital signal applied to digital signal DSIG10 input to said RF signal generator (122).

13. (Amended) Apparatus as claimed in claim 2 in which said first digital signal generator (102) provides a digital signal (DSIG3) corresponding to a common channel RF signal when applied to the RF signal generator (122), and said second and third digital signal generators (100, 103) provide output digital signals DSIG1 and DSIG2 which correspond to antenna specific RF signals when applied to said RF signal generator (122).

14. (Amended) An apparatus for testing a cellular phone comprising

an RF signal generator (122) for transmitting an RF signal (RF10) to said cellular phone;

an RF receiver (129) for receiving an RF signal (RF11) from said cellular phone (127), said RF receiver (129) generating first and second digital signals (DSIG14, DSIG15) relating to different characteristics of the received RF signal (RF11);

a digital signal generator (102) for generating a digital signal (DSIG3), which digital signal is passed to a first and a second channel;

a first antenna specific digital signal generator (103);

a second antenna specific digital signal generator (100);

whereby the digital signal (DSIG3) from the first digital signal generator in the first channel is modified by the first of the digital signals (DSIG14) from the RF receiver (129) and in the second channel is modified by the second of the digital signals (DSIG15) from the RF receiver (129), the modified digital signal (DSIG12) is said first channel being further modified by a digital signal (DSIG2) provided by the first antenna specific digital signal generator (103), and the modified digital signal (DSIG11) in the second channel being further modified by a digital signal (DSIG1) from the second antenna specific digital signal generator (100);

a first fading simulator (112) being provided in the first channel to modify the further modified digital signal (DSIG5) passing along said channel in such a manner as to replicate a preferred pattern of variation;

a second fading simulator (116) being provided in the second channel to modify the further modified digital signal (DSIG14) passing along said channel in such a manner as to replicate a preferred pattern of variation;

the digital signals (DSIG7, DSIG5) from the first and second fading simulators being combined to provide an input signal (DSIG8, DSIG10) to the RF signal generator (122);

whereby as the fading simulators modify the relevant digital signals to thereby modify the RF signal (RF10) provided by the RF signal generator (122), the cellular telephone provides a feed back signal (RF11) which modifies the digital signals in the two channels so as to compensate for the effect of the fading simulators in a measurable manner.

15. Apparatus for providing an analog signal having predetermined characteristics comprising:

analog signal generator (122) for receiving an input digital signal (DSIG10) and providing an output analog signal (RF10) having characteristics determined by the input digital signal (DSIG10) input thereto;

means (112, 116) for providing said input digital signal comprising means for receiving a digital signal (DSIG4, DSIG5), and at least one set of digital means, each set (A, B, C) of digital means comprising:

a first digital means (200, 201, 202) to provide a first digital signal element relating to a first characteristic of said analog signal, and

a second digital means (MA, MB, MC) to provide a second digital signal element relating to a second characteristic of said analog signal, and

a means (203) to combine said digital signal elements to provide said input signal to said analog signal generator.

16. Apparatus as claimed in claim 15 in which each of said set of digital means includes a third digital means to provide a third digital signal element relating to a third characteristic.

17. Apparatus as claimed in claim 16 in which said first, second and third characteristics comprise phase, amplitude and delay respectively.

Remarks

With claims 1-17 pending, claims 3, 7, 8, 12, 13 and 14 have been amended as shown above to remove multiple dependencies, and to make minor corrections. Reconsideration and allowance of all of claims 1-17 is respectfully requested.

Respectfully submitted,

Date: 12/14/01 By: Thomas Ward

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APPENDIX

The amended claims as marked up are as follows:

3. (Amended) As claimed in claim 1 [or claim 2] in which there is provided a second digital signal generator (100, 103) for generating and outputting a digital signal (DSIG1, DSIG2), second signal modifying means (105, 107) being connected to receive the digital signal (DSIG, DSIG2) from said second digital signal generator (100,103) and connected to receive said first modified digital signal (DSIG11, DSIG12) from said first signal modifying means (111,112) whereby to modify said first modified digital signal (DSIG11, DSIG12) in accordance with said digital signal (DSIG1, DSIG2) from said second digital signal generator (100, 103) to thereby output a second modifies digital signal (DSIG4, DSIG5) to provide the basis of said digital signal (DSIG10) input to said RF signal generator (122).

6. (Amended) Apparatus as claimed in claim[s] 5 in which the fading simulator includes means to vary one or more of said digital signal elements in accordance with a predetermined pattern with respect to time.

7. (Amended) Apparatus as claimed claim 1 [in any of claims 1 to 6] in which the or each digital signal generator outputs a digital signal including digital signal elements relating to one or more of phase, amplitude, and delay in respect of the resultant RF signal (RF10) transmitted by the RF signal generator (122).

8. (Amended) Apparatus as claimed in claim 1 [or 2] in which said RF receiver (129) includes means to generate two output digital signals (DSIG14, DSIG15) having characteristics based on different characteristics of the RF signal (RFII) received by the receiver (129), and there are provided a second and third digital signal generators (100, 103) which output respective digital signals (DSIG1, DSIG2), said signal modifying means (111, 112) comprising firs and second signal modifying means (111,112) connected to respectively receive a digital signal (DSIG3) from said first digital signal generator (102) and to receive a respective digital signal (DSIG14, DSIG15) from said RF receiver (129) whereby to modify said digital signal (DSIG3) from said first digital signal generator (102) in accordance with said digital signal (DSIG14, DSIG15) from said RF receiver to thereby output a respective first and second modified signal (DSIG11, DSIG12), third and fourth signal modifying means (105, 107) connected to receive a digital

signal (DSIG1, DSIG2) from a respective one of the second or third digital signal generators (100,103) and connected to receive said digital signal (DSIG11, DSIG12) from a respective one of said first or second signal modifying means 111, 112 whereby to modify the respective modified digital signal (DSIG11, DSIG12) in accordance with said digital signal (DSIG1, DSIG2) from the relevant second or third digital signal generator (100, 103) and to thereby output third and fourth modified digital signals (DSIG4, DSIG5), a combination of digital signals derived from said third and fourth modified signals (DSIG4, DSIG5) providing said digital signal input to said RF signal generator (122).

12. (Amended) Apparatus as claimed in claim 1 [any of claims 1 to 11] in which it is provided a white noise digital signal generator (124), the digital output signal DSIG9 of said white noise digital signal generator being applied to the digital signal applied to digital signal DSIG10 input to said RF signal generator (122).

13. (Amended) Apparatus as claimed in claim 2 [and 8] in which said first digital signal generator (102) provides a digital signal (DSIG3) corresponding to a common channel RF signal when applied to the RF signal generator (122), and said second and third digital signal generators (100, 103) provide output digital signals DSIG1 and DSIG2 which correspond to antenna specific RF signals when applied to said RF signal generator (122).

14. (Amended) An apparatus for testing a cellular phone comprising

an RF signal generator (122) for transmitting an RF signal (RF10) to said cellular phone;

an RF receiver (129) for receiving an RF signal (RF11) from said cellular phone (127), said RF receiver (129) generating first and second digital signals (DSIG14, DSIG15) relating to different characteristics of the received RF signal (RF11);

a digital signal generator (102) for generating a digital signal (DSIG3), which digital signal is passed to a first and a second channel;

a first antenna specific digital signal generator (103);

a second antenna specific digital signal generator (100);

whereby the digital signal (DSIG3) from the first digital signal generator in the first channel is modified by the first of the digital signals (DSIG14) from the RF receiver (129) and in the second channel is modified by the second of the digital signals (DSIG15) from the RF receiver (129), the modified digital signal (DSIG12) is said first channel being further modified

by a digital signal (DSIG2) provided by the first antenna specific digital signal generator (103), and the modified digital signal (DSIG11) in the second channel being further modified by a digital signal (DSIG1) from the second antenna specific digital signal generator (100);

a first fading simulator (112) being provided in the first channel to modify the further modified digital signal (DSIG5) passing along said channel in such a manner as to replicate a preferred pattern of variation;

a second fading simulator (116) being provided in the second channel to modify the further modified digital signal (DSIG14) passing along said channel in such a manner as to replicate a preferred pattern of variation;

the digital signals (DSIG7, DSIG5) from the first and second fading simulators being combined to provide an input signal (DSIG8, DSIG10) to the RF signal generator (122);

whereby as the fading simulators modify the relevant digital signals to thereby modify the RF signal (RF10) provided by the RF signal generator (122), the cellular telephone provides a feed back signal (RF11) which modifies the digital signals in the two channels so as to compensate for the effect of the fading simulators in a measurable manner.

TESTING MOBILE PHONES

The present invention relates to the testing of cellular mobile phones and in particular a method for testing third generation (3G) cellular mobile phones. 3G cellular radio systems will employ a new technique called Tx diversity in order to improve reception and increase the overall efficiency of the network. Two or more signal generator antennae will be used at each base station.

It is well known that mobile phone communications are provided by transmission of signals in both directions between an antenna at a base station and a mobile phone. Conditions may vary in the path between the base station and the mobile phone and this can create problems, such as fading. In first generation (analog) mobile telephony, the rate of information fed along the channel from the base station to the mobile phone (and vice versa) is relatively slow and the delay spread caused by changes in the environment between the base station and the mobile phone is less than one data symbol. For example, the delay spread is usually 15 microseconds or less. Thus, a mobile phone receiver does not notice this.

However, in more recent (second generation) mobile telephony, for example GSM, the transmission rate is much faster and so it is possible for the delay spread to be of the same order of magnitude as the information rate. (Eg one piece of information every 3.6 microsecond.) As a result, the signal when received by the GSM mobile phone may include echoes. There may be many echoes because the signal may be received by the mobile phone via a variety of different paths with different environmental effects.

The mobile phone will normally deal with this by tuning to each echo and combining all or several echoes to determine the transmitted information. The echoes may exhibit time diversity, that is echoes of the same data signal may arrive at different times (out of phase) and as a result, depending on the phase relationship of the echoes, the echoes may add or subtract which can create fading or increase of the signal. If the two echoes cancel each other out then the mobile phone, which provides an indication back

to the base station of the signal strength which is it receiving, will effectively instruct the base station to increase the power output and this is undesirable for a number of reasons.

It has been proposed to overcome or reduce these problems in the 3G wireless telephony base stations by providing at some or all of the base stations two (or more) antennae usually separated by fractions or multiples of the wavelength of the signal, for example, half, one, two wavelengths and transmitting antenna specific signals such that a mobile phone can distinguish them and then feed back signals to separately correct the relevant antenna output.

The RF receiver in the 3G mobile telephone includes a system which can separate out a relevant part of the signals from the two antennae. The mobile phone measures the power and phase of the signal received from the first antenna and the power and phase of the signal received from the second antenna and transmits a signal back to the base station to cause the base station to adjust the phase and power between the two antennae so as to improve the reception at the mobile phone. In practice, each antenna transmits a signal which comprise two components, firstly a component which relates to the common information (ie traffic and typically relates to the information being transmitted to the mobile phone), and a second antenna specific signal (a pilot signal) which enables the mobile phone to distinguish which antenna is which.

The mobile phone uses the pilot signal to measure the phase and power received from each antenna and to thereby provide the information returned to the base station to adjust the output of the antennae.. Thus the mobile phone returns to the base station a complex vector signal which sets out the relationship between the pilot signals from each antenna and generally will try to get the same power and same phase from each antenna. In a typical system, the mobile phone will send sixteen hundred correction signals per second back to the base station so that as the relative strengths and phases of the signals from each antenna vary in real time, the signals on the two antennae may be corrected so as to counter the effect of fading.

For a particular design of mobile phone to be approved for use with the system, it is necessary to be able to test that mobile phone to see whether or not it will be able to identify the signals from each antenna and sufficiently accurately measure the power and phase of the signals so as to be able to operate the system properly.

The present application relates to a method and apparatus for testing mobile phones, particularly 3G mobile phones in this way. Of course it is possible to test each individual mobile phone separately, but in practice the present arrangement is intended to be used for each particular design of mobile phone during its development so as to ensure that the design complies with the necessary standard. Such apparatus is also useful in conformance testing, research and development, as well as production.

It is preferred that the apparatus and method may simulate conditions found in real life, so that the signals between the two antennae may be set at particular static levels, and may also be dynamically varied.

A traditional approach which might be applied to testing 3G mobile phones is diagrammatically set out in Figure 1. There is provided two (or more) base station simulators (S1, S2) which each provide a relevant RF (radio frequency) signal output, RF1, RF2, each RF output signal being passed through a respective fading simulator, FS1, FS2, and thereby providing a respective new RF signal, RF3, RF4. These two RF signals are combined in a summer 11 and the combined RF signal RF5 is passed by a coaxial line 12A, 12B via an extractor 13 to the antenna input 15 of a mobile phone 14 under test. The antenna of the mobile phone 14 transmits a signal RF6 (at a different frequency to RF5) which passes to the extractor 13 where it is separated from RF5 and passed to a signal processor 16 which provides two non-RF signal outputs SIG7, SIG8, dependent upon the power and phase of RF3, RF4 respectively. These signals, SIG7, SIG8, are passed to the base station simulators, S1, S2.

Such an arrangement, of course, replicates the system in the field, the two base signal simulators providing RF signals replicating those produced by the two antennae, and

the two RF signals being summed to be passed to the mobile phone 14, and the signal RF6 replicating the return signal to the antennae. There are a number of problems associated with this arrangement and these generally relate to the summer 11, to the various coaxial cables and the extractor 13. The coaxial cable is important. The length of the coaxial cable is particularly important because there is a phase change along the length of the coaxial cable. Thus, in terms of the length of cable between S1, S2 and the summer 11 there may be an unintentional phase change, and the summer can introduce a phase change. The coaxial cable can also introduce reflections into the system. It is also difficult to accurately maintain and generate the same power outputs via two fading simulators. In practice it is necessary to measure the signal passing along the coaxial cable 11 to adjust the various components including the base station simulators S1, S2 and the fading simulators FS1, FS2 so as to provide a signal of a known desired type to the mobile phone 14.

There are similar problems in dealing with the signal RF6.

The present invention relates to a method and apparatus arranged so as to reduce or remove the above problems.

Reference may also be made to Kall J: 'the GSM system simulator' proceedings of the European conference on Electrotechnics. (Eurocon), US, New York, IEEE, vol. Conf. 8, 1988, pages 478-481, which discloses GSM system simulator comprising a collection of emulation and measurement tools to be used when testing mobile stations for conformance with the CEPT/GSM recommendations.

Reference may also be made to the US Patent Specification, 4 669 091 which discloses a communication system which transmits information which may be in the form of frames or busts of suppressed-carrier data over a dispersive transmission path which introduces multipath distortion. Each frame is stored as it is received and processed by iteratively simulating the multipath distortion, subtracting the distortion from the stored frame to form a corrected signal, and evaluating the quality of the resulting

signal. The quality of the resulting signal is determined by frequency multiplying the corrected signal and evaluating the total power of components other than the frequency multiplied carriers. The iterative procedure adjusts the phase and, if desired, the amplitude of signals tapped from a delay line.

The present invention provides an apparatus for testing a radio apparatus of a type which receives a radio frequency (RF) signal from a RF signal generator and sends a RF signal to a receiver to modify the characteristics of the RF signal transmitted by said signal generator, said apparatus comprising:

an RF signal generator for transmitting an RF signal (RF10) to said radio apparatus, and means to receive an input digital signal (DSIG10), which signal generator controls the characteristics of the RF signal (RF10) transmitted in accordance with the input digital signal (DSIG10);

an RF receiver for receiving an RF signal (RF11) from said radio apparatus, said RF receiver including means to generate an output digital signal (DSIG14, DSIG15) having characteristics dependent on the characteristics of the RF signal (RF11) received;

a digital signal generator for generating and outputting a digital signal (DSIG3);

signal modifying means connected to receive said digital signal (DSIG3) from said digital signal generator and to receive said digital signal (DSIG14, DSIG15) from said RF receiver whereby to modify said digital signal (DS1G3) from said digital signal generator in accordance with said digital signal (DSIG14, DSIG15) from said RF receiver to thereby output a first modified digital signal (DSIG11, DSIG12) to provide the basis of said digital signal (DSIG10) input to said RF signal generator.

The present invention may also provide an apparatus for testing a cellular phone comprising

an RF signal generator for transmitting an RF signal (RF10) to said cellular phone;

an RF receiver for receiving an RF signal (RF11) from said cellular phone, said RF receiver generating first and second digital signals (DSIG14,DSIG15) relating to different characteristics of the received RF signal (RF11);

a digital signal generator for generating a digital signal (DSIG3), which digital signal is passed to a first and a second channel;

a first antenna specific digital signal generator;

a second antenna specific digital signal generator;

whereby the digital signal (DSIG3) from the first digital signal generator in the first channel is modified by the first of the digital signals (DSIG14) from the RF receiver and in the second channel is modified by the second of the digital signals (DSIG15) from the RF receiver, the modified digital signal (DSIG12) in said first channel being further modified by a digital signal (DSIG2) provided by the first antenna specific digital signal generator, and the modified digital signal (DSIG11) in the second channel being further modified by a digital signal (DSIG1) from the second antenna specific digital signal generator;

a first fading simulator being provided in the first channel to modify the further modified digital signal (DSIG5) passing along said channel in such a manner as to replicate a preferred pattern of variation;

a second fading simulator being provided in the second channel to modify the further modified digital signal (DSIG14) passing along said channel in such a manner as to replicate a preferred pattern of variation;

the digital signals (DSIG7,DSIG5) from the first and second fading simulators being combined to provide an input signal (DSIG8,DSIG10) to the RF signal generator;

whereby as the fading simulators modify the relevant digital signals to thereby modify the RF signal (RF10) provided by the RF signal generator, the cellular telephone provides a feed back signal (RF11) which modifies the digital signals in the two channels so as to compensate for the effect of the fading simulators in a measurable manner.

The present invention may also provide an apparatus for providing an analog signal having predetermined characteristics comprising:

analog signal generator for receiving an input digital signal (DSIG10) and providing an output analog signal (RF10) having characteristics determined by the input digital signal (DSIG10) input thereto:

means for providing said input digital signal comprising means for receiving a digital signal (DSIG4, DSIG5), and at least one set of digital means, each set (A, B, C) of digital means comprising:

a first digital means to provide a first digital signal element relating to a first characteristic of said analog signal, and

a second digital means (MA, MB, MC) to provide a second digital signal element relating to a second characteristic of said analog signal, and

a means to combine said digital signal elements to provide said input signal to said analog signal generator.

A preferred embodiment will now be described by way of example only and with reference to the accompanying drawings in which:-

Figure 2 sets out the apparatus of the invention diagrammatically, and,

Figure 3 shows in diagrammatic form the arrangement of each fade simulator.

Referring to Figure 2 there are shown three baseband (ie non-RF) digital signal generators, 100, 102, 103, signal generator 100 producing an antenna specific coding signal DSIG1 which, relates to the pilot signal of a first antenna. The output signal DSIG1 which is digital is passed along line 104 to a multiplier 105. The baseband digital signal generator 103 produces an antenna specific coded signal DSIG2 similar to that produced by 100 but relating to the pilot signal of the second antenna. The output digital signal DSIG2 is passed via line 106 to a multiplier 107.

Baseband digital signal generator 102 is arranged to provide, in digital form, the common channel signal DSIG3 (corresponding, for example, to the traffic signal carrying, for example, the telephone message) and is passed via line 108 and multipliers 111, 112, respectively to multipliers 105, 107. The digital output signal DSIG4 of the multiplier 105 is passed via line 113 to a fading simulator 116 to be described in more detail with reference to Figure 3 later and the digital output signal DSIG5 of multiplier 107 is similarly passed along line 114 to a fading simulator 112 to be described in more detail with reference to Figure 3 later. The output signal DSIG6 of fading simulator 116 is passed via line 118 to a summer 119 and similarly the output signal DSIG7 of the fading simulator 112 is passed via line 117 to the other input of the summer 119. The output signal DSIG8 of the summer 119 is passed via summer 121 to a radio frequency signal generator 122. The summer 121 is also connected via switch 123 to a noise generator, in particular, an Additive Gaussian White Noise generator 124 (which simulates traffic on the network). It will be noted that the signal input to the generator 122 is a digital baseband signal.

The components 103, 112, 107, 112, provide a first channel A and the components 100, 111, 105, 116, provide a second channel B.

The RF output signal RF10 from the signal generator 122 is provided to an RF line 126 in the form of coaxial cable connected to an antenna input of a mobile phone 127

under test via a separator 125.

The radio frequency output signal RF11 from the antenna port of the mobile phone 127 when separated by separator 125 is passed by a coaxial line 128 to a processing apparatus 129.

The processing apparatus 129 processes the signal received and provides two output signals W1 and W2 on lines 131, 132 respectively, which are passed to the other inputs of the multipliers 112, 111 respectively.

The apparatus of Figure 2 operates as follows.

A mobile phone 127 to be tested is connected to the apparatus as shown in Figure 2. The mobile phone may be a phone in the design or development phase whereby the apparatus may be used to test the efficiency of operation of the design, or alternatively, may be used to test production mobile phones.

The antenna or an antenna port of the mobile phone is connected to the coaxial line 130 by a suitable connector.

In use, the two baseband digital signal generators 100, 103 provide a respective digital baseband signal, each of which is multiplied with the common channel signal provided by the signal generator 102 at the respective multipliers 105, 107. Fading simulators 116, 117 are operated in accordance with a prearranged schedule (to be described later) and the two signals from the respective fading simulators are combined at summer 119, are furthermore combined with the white signal noise at summer 121 and the combined digital signal is used to control the RF signal generator 122 which thereby provides a signal RF10 based on the combined data signal.

In a first test procedure, the outputs of the various signal generators 100, 102, 103, and the operation of the fading simulators 116, 117, are set to preset static conditions

so as to produce at 118, 117, digital signals which relate to RF signals which are of a known power level and phases which are of a known offset.
The mobile phone 127 is then tested and the relevant values determined by the phone 127 are compared with the known offset and known signal level and these must agree to within specified limits.

Before describing a second operation of the apparatus in which the fading simulators 116, 117 are operated in accordance with a prearranged schedule, which will be described later, it is convenient at this point to describe the operation of the fading simulators used in a preferred embodiment of the invention.

We will now describe the fading simulators 117, 116 with reference to Figure 3. The fading simulators are devices which take an input signal DSIG4 or DSIG5 and produce an output DSIG6 or DSIG7 respectively in which:-

(a) the phase of the output signal is selectively varied with respect to the phase of the input signal, and the amplitude of the output signal is selectively varied with respect to the amplitude of the input signal, and/or

(b) the output signal DSIG6 or DSIG7 includes plural components which correspond to echoes, each of the plural components having a variable amplitude and variable phase with respect to the input and with respect to each other.

In essence, the input signal (DSIG14, DSIG15) to the fading simulator is passed to a plurality of parallel channels A, B, C each of which includes a respective variable delay apparatus (200, 201, 202). The delay to the signal created by the delay apparatus may either be statically arranged or the delay apparatuses may be controlled by a respective control signal (SA, SB, SC respectively) applied to each delay apparatus to vary the delay in a known or random manner.

The outputs of each delay are passed to a respective multiplier (MA, MB, MC). Each

multiplier has an input to which a complex control signal (PA, PB, PC) is provided, the complex signal either being preset or varied in a known or random manner. The outputs of the multipliers are combined in summer (203) to provide a single signal output (DSIG6, DSIG5) which carries a signal which has a number of components corresponding to the number of delays which thereby have independent variable amplitudes and independent variable phase shifts, and it will be understood that the amplitude and phase shifts may be static or may be changed in accordance with a known pattern, or may be changed in a random manner. Each of these signal components produced by the channels A, B, C respectively will effectively correspond to a separate echo in the RF signal (RF10) and will be handled by the mobile phone as if they were echos produced in the field.

Thus in the second operation of the apparatus, in distinction to the first operation of the apparatus in which the signal DSIG6 or DSIG7 has a number of components with a fixed relationship with respect to amplitude and phase to the input signal DSIG4 or DSIG5, the phase and amplitude of the components of the signal DSIG6 and DSIG7 will vary with time either in a random manner or in a predetermined manner. (It is useful to use a predetermined pattern of variation because this enables one then to compare different mobile phones with exactly the same signal.)

The way in which the efficiency and operation of the mobile phone is tested in this case is to arrange for the signal generator 102 to provide a prearranged digital pattern, and for the mobile phone to report the error bit rate. The error bit rate must be within predetermined limits and also it may be shown by switching off the feed back arrangements (for example by breaking the link 128) that the mobile phone when utilising the system calling the invention provides an improved error bit rate than without using the system of the invention.

It will be understood that the present invention provides an improved apparatus for testing mobile phones in this environment.

In the described arrangement, there is only a single RF signal generator 122 and the simulation of the two antennae takes place in the baseband digital domain between the signal generators 100, 102, 103 and fading simulators 116, 117. Since the signals are digital at this point, the relative level and phase can be very accurately controlled.

Since it is mainly the relative values that are important (for each antenna) and since they are all in the digital domain, the system is intrinsically accurate. Absolute levels are more easily controlled and only one RF generator is required.

The invention is not restricted to the details of the foregoing example.

The Additive Gaussian White Noise generator 124 provides a noise source which in the example shown in Figure 2 is summed in the digital domain but can if necessary be applied to the RF signal output from the RF signal generator 122. By the arrangement provided, only a single such noise source is required.

CLAIMS

1. An apparatus for testing a radio apparatus of a type which receives a radio frequency (RF) signal from a RF signal generator and sends a RF signal to a receiver to modify the characteristics of the RF signal transmitted by said signal generator, said apparatus comprising:

an RF signal generator (122) for transmitting an RF signal (RF10) to said radio apparatus (127), and means to receive an input digital signal (DSIG10), which signal generator (122) controls the characteristics of the RF signal (RF10) transmitted in accordance with the input digital signal (DSIG10);

an RF receiver (129) for receiving an RF signal (RF11) from said radio apparatus (127), said RF receiver (129) including means to generate an output digital signal (DSIG14, DSIG15) having characteristics dependent on the characteristics of the RF signal (RF11) received;

a digital signal generator (102) for generating and outputting a digital signal (DSIG3);

signal modifying means (111, 112) connected to receive said digital signal (DSIG3) from said digital signal generator (102) and to receive said digital signal (DSIG14, DSIG15) from said RF receiver (129) whereby to modify said digital signal (DS1G3) from said digital signal generator (102) in accordance with said digital signal (DSIG14, DSIG15) from said RF receiver to thereby output a first modified digital signal (DSIG11, DSIG12) to provide the basis of said digital signal (DSIG10) input to said RF signal generator (122).

2. Apparatus as claimed in claim 1 in which said radio apparatus comprises a cellular phone.

3. Apparatus as claimed in claim 1 or claim 2 in which there is provided a second digital signal generator (100, 103 for generating and outputting a digital signal (DSIG1, DSIG2), second signal modifying means (105, 107) being connected to receive the digital signal (DSIG, DSIG2) from said second digital signal generator

(100, 103) and connected to receive said first modified digital signal (DSIG11, DSIG12) from said first signal modifying means (111, 112) whereby to modify said first modified digital signal (DSIG11, DSIG12) in accordance with said digital signal (DSIG1, DSIG2) from said second digital signal generator (100, 103) to thereby output a second modified digital signal (DSIG4, DSIG5) to provide the basis of said digital signal (DSG10) input to said RF signal generator (122).

4. Apparatus as claimed in claim 3 including a digital fading simulator (112, 116), connected to receive said second modified digital signal, the output (DSIG6, DSIG7) of the digital fading simulator comprising the second modified digital signal (DSIG4, DSIG5) the characteristics of which have been modified.

5. Apparatus as claimed in claim 4 in which said digital fading simulator includes means to change at least one of said digital signal elements of said second modified digital signal (DSIG4, DSIG5) to thereby change the phase or amplitude or delay of the RF signal (RF10) transmitted by said RF signal generator (122).

6. Apparatus as claimed in claims 5 in which the fading simulator includes means to vary one or more of said digital signal elements in accordance with a predetermined pattern with respect to time.

7. Apparatus as claimed in any of claims 1 to 6 in which the or each digital signal generator outputs a digital signal including digital signal elements relating to one or more of phase, amplitude, and delay in respect of the resultant RF signal (RF10) transmitted by the RF signal generator (122).

8. Apparatus as claimed in claim 1 or 2 in which said RF receiver (129) includes means to generate two output digital signals (DSIG14, DSIG15) having characteristics based on different characteristics of the RF signal (RFII) received by the receiver (129), and there are provided a second and third digital signal generators (100, 103) which output respective digital signals (DSIG1, DSIG2), said signal modifying means

(111, 112) comprising first and second signal modifying means (111,112) connected to respectively receive a digital signal (DSIG3) from said first digital signal generator (102) and to receive a respective digital signal (DSIG14, DSIG15) from said RF receiver (129) whereby to modify said digital signal (DSIG3) from said first digital signal generator (102) in accordance with said digital signal (DSIG14, DSIG15) from said RF receiver to thereby output a respective first and second modified signal (DSIG11, DSIG12), third and fourth signal modifying means (105, 107) connected to receive a digital signal (DSIG1, DSIG2) from a respective one of the second or third digital signal generators (100, 103) and connected to receive said digital signal (DSIG11, DSIG12) from a respective one of said first or second signal modifying means 111, 112 whereby to modify the respective modified digital signal (DSIG11, DSIG12) in accordance with said digital signal (DSIG1, DSIG2) from the relevant second or third digital signal generator (100, 103) and to thereby output third and fourth modified digital signals (DSIG4, DSIG5), a combination of digital signals derived from said third and fourth modified signals (DSIG4, DSIG5) providing said digital signal input to said RF signal generator (122).

9. Apparatus as claimed in claim 8 including:

a first digital fading simulator (116), connected to receive said third modified digital signal (DSIG4), the output (DSIG6) of the first digital fading simulator (116) comprising a fifth modified digital signal (DSIG6) the characteristics of which have been modified by said first digital fading simulator;

a second digital fading simulator (112), connected to receive said fourth modified digital signal (DSIG5), the output (DSIG6) of the second digital fading simulator (116) comprising a sixth modified digital signal (DSIG7) the characteristics of which have been modified by said second digital fading simulator; and

a digital signal combines means (119) to combine said fifth and sixth digital signal to provide a seventh digital signal (DSIG8).

10. Apparatus as claimed in claim 9 in which each digital fading simulator (116, 112) includes means to change at least one of said digital signal elements of said third

or fourth modified digital signal (DSIG4, DSIG5) to thereby change the phase or amplitude or delay of the RF signal (RF10) transmitted by said RF signal generator (122).

11. Apparatus as claimed in claims 10 in which each digital fading simulator (116, 112) includes means to vary one or more of said digital signal elements in accordance with a predetermined pattern with respect to time.

12. Apparatus as claimed in any of claims 1 to 11 in which it is provided a white noise digital signal generator (124), the digital output signal DSIG9 of said white noise digital signal generator being applied to the digital signal applied to digital signal DSIG10 input to said RF signal generator (122).

13. Apparatus as claimed in claim 2 and 8 in which said first digital signal generator (102) provides a digital signal (DSIG3) corresponding to a common channel RF signal when applied to the RF signal generator (122), and said second and third digital signal generators (100, 103) provide output digital signals DSIG1 and DSIG2 which correspond to antenna specific RF signals when applied to said RF signal generator (122).

14. An apparatus for testing a cellular phone comprising

an RF signal generator (122) for transmitting an RF signal (RF10) to said cellular phone;

an RF receiver (129) for receiving an RF signal RF11) from said cellular phone (127), said RF receiver (129) generating first and second digital signals (DSIG14,DSIG15) relating to different characteristics of the received RF signal (RF11);

a digital signal generator (102) for generating a digital signal (DSIG3), which digital signal is passed to a first and a second channel;

a first antenna specific digital signal generator (103);

a second antenna specific digital signal generator (100);

whereby the digital signal (DSIG3) from the first digital signal generator in the first channel is modified by the first of the digital signals (DSIG14) from the RF receiver (129) and in the second channel is modified by the second of the digital signals (DSIG15) from the RF receiver (129), the modified digital signal (DSIG12) in said first channel being further modified by a digital signal (DSIG2) provided by the first antenna specific digital signal generator (103), and the modified digital signal (DSIG11) in the second channel being further modified by a digital signal (DSIG1) from the second antenna specific digital signal generator (100);

a first fading simulator (112)being provided in the first channel to modify the further modified digital signal (DSIG5) passing along said channel in such a manner as to replicate a preferred pattern of variation;

a second fading simulator (116) being provided in the second channel to modify the further modified digital signal (DSIG14) passing along said channel in such a manner as to replicate a preferred pattern of variation;

the digital signals (DSIG7,DSIG5) from the first and second fading simulators being combined to provide an input signal (DSIG8,DSIG10) to the RF signal generator (122) ;

whereby as the fading simulators modify the relevant digital signals to thereby modify the RF signal (RF10) provided by the RF signal generator (122), the cellular telephone provides a feed back signal (RF11) which modifies the digital signals in the two channels so as to compensate for the effect of the fading simulators in a measurable manner.

15. Apparatus for providing an analog signal having predetermined characteristics comprising:

analog signal generator (122) for receiving an input digital signal (DSIG10) and providing an output analog signal (RF10) having characteristics determined by the input digital signal (DSIG10) input thereto:

means (112, 116) for providing said input digital signal comprising means for receiving a digital signal (DSIG4, DSIG5), and at least one set of digital means, each set (A, B, C) of digital means comprising:

a first digital means (200, 201, 202) to provide a first digital signal element relating to a first characteristic of said analog signal, and

a second digital means (MA, MB, MC) to provide a second digital signal element relating to a second characteristic of said analog signal, and

a means (203) to combine said digital signal elements to provide said input signal to said analog signal generator.

16. Apparatus as claimed in claim 15 in which each of said set of digital means includes a third digital means to provide a third digital signal element relating to a third characteristic.

17. Apparatus as claimed in claim 16 in which said first, second and third characteristics comprise phase, amplitude and delay respectively.

ABSTRACT

An apparatus for testing a cellular phone comprising an RF signal generator (122) for transmitting an RF signal (RF10) to said cellular phone, said RF signal generator receiving an input digital signal (DSIG10) which determines the characteristics of the RF signal, means (112, 116) for providing said input digital signal comprising means for receiving a digital signal (DSIG4, DSIG5), and at least one set of digital means, each set (A, B, C) of digital means comprising:

a first digital means (200, 201, 202) to provide a first digital signal element relating to a first characteristic of said RF signal, and

a second digital means (MA, MB, MC) to provide a second digital signal element relating to a second characteristic of said RF signal, and

a means (203) to combine said digital signal elements to provide said input signal to said RF signal generator, said first, second and third characteristics comprise phase, amplitude and delay respectively. Thus the signal processing is carried out in the digital phase which is more easily controlled.

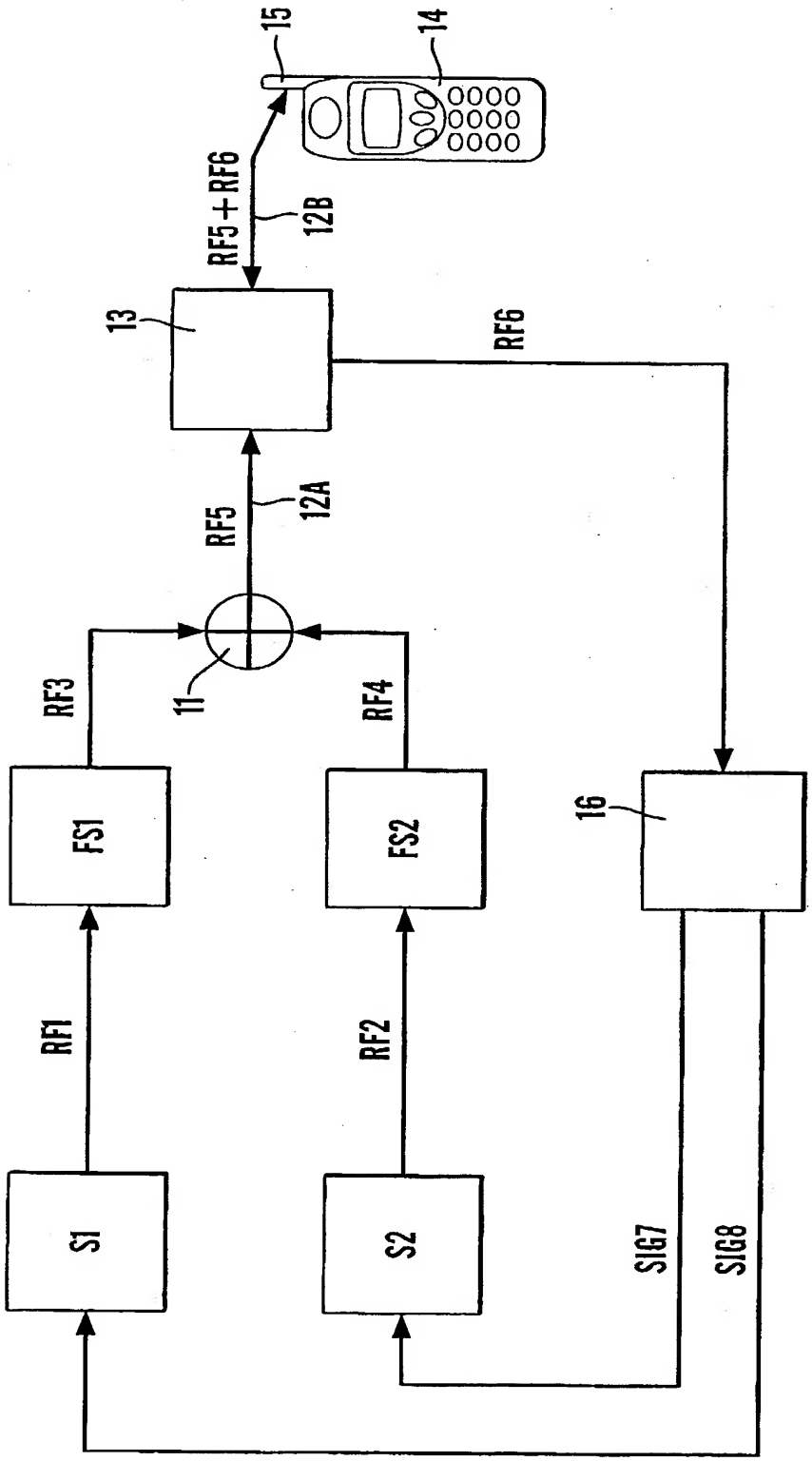
15
14
RF5+RF6
12B
13
RF6
RF5
12A
11
RF3
RF4
FS1
FS2
16
RF1
RF2
S1
S2
SIG7
SIG8

Fig. 1

ANTENNA SPECIFIC CODING
DEDICATED CHANNELS DPCH
ANTENNA SPECIFIC CODING
BASEBAND SIGNALS
DSIG1
DSIG2
DSIG3
DSIG4
DSIG5
DSIG6
DSIG7
DSIG8
DSIG9
DSIG10
DSIG11
DSIG12
DSIG14
DSIG15
F.S.
F.S.
AWGN
SIGNAL GENERATOR
DPCCH PROCESSING
RF10
RF11
RF11+RF10
W1
W2
100
102
103
104
105
106
107
108
111
112
113
114
116
117
118
119
121
122
123
124
125
126
127
128
129
130

Fig.2

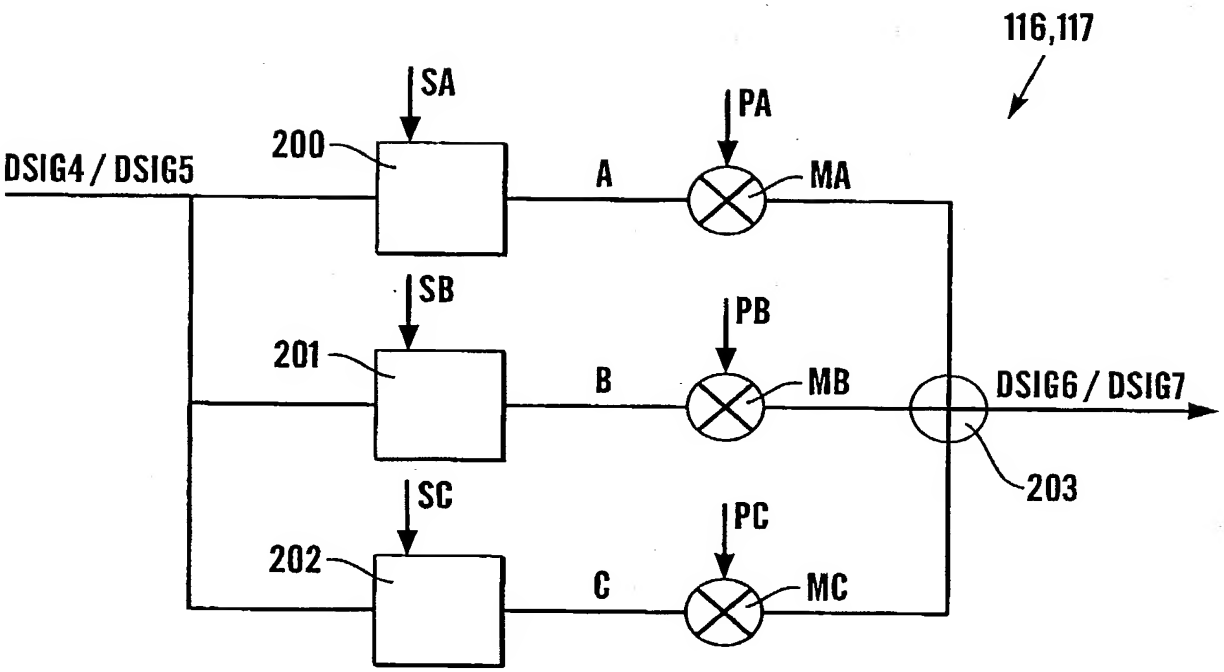
116,117
SA
PA
200
DSIG4 / DSIG5
A
MA
SB
PB
201
B
MB
DSIG6 / DSIG7
203
SC
PC
202
C
MC

Fig.3

IN THE UNITED STATES PATENT AND TRADEMARK OFFICE

In re Application	
Inventor(s):	Michael John Lee
SC/Serial No.:	Unknown
Filed:	Not Yet Assigned
PCT Application No.:	PCT/GB00/02267
Filed:	June 12, 2000
Title:	APPARATUS FOR TESTING MOBILE PHONES

PATENT APPLICATION

Art Unit: Unknown
Examiner: Unknown

Customer No. 23910

DECLARATION FOR PATENT APPLICATION

As a below named inventor, I hereby declare that my residence, mailing address and citizenship are as stated below next to my name. I believe that I am the original, first and sole inventor (if only my name is listed below) or the original, first and joint inventor (if plural names are listed below) of the subject matter which is claimed and for which a patent is sought on the invention identified by "Title" above and by the specification identified below (check applicable ones):

The specification:

_____ is attached hereto;
_____ was filed with the above-identified "SC/Serial No." and "Filed" date (national or PCT international);
_____ was amended on (or through) _____.

I have reviewed and understand the contents of the above-identified specification including the claims and including any above-identified amendment(s).

I acknowledge a duty to disclose to the U.S. Patent and Trademark Office all information known to me to be material to patentability of the application as defined in Title 37, Code of Federal Regulations §1.56.

I hereby claim foreign priority benefits under 35 U.S.C. §119(a)-(d) or §365(b) of any foreign application(s) for patent or inventor's certificate, or §365(a) of any PCT international application which designated at least one country other than the United States, listed below and have also identified below any foreign application for patent or inventor's certificate, or PCT international application, filed by me or my assignee disclosing the subject matter claimed in this application and having a filing date (1) before that of the application on which priority is claimed, or (2) if no priority is claimed, before the filing date of this application:

Prior Foreign Application(s)

Number	Country	Day/Month/Year Filed	Priority Claimed Yes	No
9913843.0	GB	June 14, 1999	X	

I hereby claim the benefit under 35 U.S.C. §120 of any United States application(s), or §365(c) of any PCT international application designating the United States, listed below and insofar as the subject matter of each of the claims of this application is not disclosed in such prior United States or PCT International applications in the manner provided by the first paragraph of 35 U.S.C. §112, I acknowledge the duty to disclose material information as defined in 37 C.F.R. §1.56 which occurred between the filing date of the prior applications and the national or PCT international filing date of this application:

Prior U.S. or PCT Application(s)

Application Serial No.	Day/Month/Year Filed	Status: (patented, pending, abandoned)
a) PCT/GB00/02267	June 12, 2000	pending

I hereby declare that all statements made herein of my own knowledge are true and that all statements made on information and belief are believed to be true, and further that these statements were made with the knowledge that willful false statements and the like so made are punishable by fine or imprisonment, or both, under §1001 of Title 18 of the United States Code and that such willful false statements may jeopardize the validity of the application or any patent issuing thereon.

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1.30

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(1) Citizenship: Great Britain

(1) Date: 6th Feb 2002 (1) Inventor's signature: M. O. Lee

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Title 35, United States Code, §112 (first paragraph)

SECTION 112. SPECIFICATION

The specification shall contain a written description of the invention, and of the manner and process of making and using it, in such full, clear, concise, and exact terms as to enable any person skilled in the art towhich it pertains, or with which it is most nearly connected, to make and use the same, and shall set forth the best mode contemplated by the inventor of carrying out his invention.

Title 35, United States Code §119 (first paragraph)

BENEFIT OF EARLIER FILING DATE IN FOREIGN COUNTRY; RIGHT OF PRIORITY

(a) An application for patent for an invention filed in this country by any person who has, or whose legal representatives or assigns have, previously regularly filed an application for a patent for the same invention in a foreign country which affords similar privileges in the case of applications filed in the United States or to citizens of the United States, shall have the same effect as the same application would have if filed in this country on the date on which the application for patent for the same invention was first filed in such foreign country, if the application in this country is filed within twelve months from the earliest date on which such foreign application was filed; but no patent shall be granted on any application for patent for an invention which had been patented or described in a printed publication in any country more than one year before the date of the actual filing of the application in this country, or which had been in public use or on sale in this country more than one year prior to such filing.

(b) No application for patent shall be entitled to this right of priority unless a claim therefor and a certified copy of the original foreign application, specification, and drawings upon which it is based are filed in the Patent and Trademark Office before the patent is granted, or at such time during the pendency of the application as required by the Commissioner not earlier than six months after be made by the patent office of the foreign country in which filed and show the date of the application and of the filing of the specification and other papers. The Commissioner may require a translation of the papers filed if not in the English language and such other information as he deems necessary.

(c) In like manner and subject to the same conditions an requirements, the right provided in this section may be based upon a subsequent regularly filed application in the same foreign country instead of the first filed foreign application, provided that any foreign application filed prior to such subsequent application has been withdrawn, abandoned, or otherwise disposed of, without having been laid open to public inspection and without leaving any rights outstanding, and has not served, nor thereafter shall serve, as a basis for claiming a right of priority.

(d) Applications for inventors' certificate filed in a foreign country in which applicants have a right to apply, at their discretion, either for a patent or for an inventor's certificate shall be treated in this country in the same manner and have the same effect for purpose of the right of priority under this section as applications for patents, subject to the same conditions and requirements of this section as apply to applications for patents, provided such applicants are entitled to the benefits of the Stockholm Revision of the Paris Convention at the same time of such filing.

(e)(1) An application for patent filed under section 111(a) or section 363 of this title for an invention disclosed in the manner provided by the first paragraph of section 112 of this title in a provisional application filed under section 111(b) of this title, by an inventor or inventors named in the provisional application, shall have the same effect, as to such invention, as though filed on the date of the provisional application filed under section 111(b) of this title, if the application for patent filed under section 111(a) or section 363 of this title is filed not later than 12 months after the date on which the provisional application was filed and if it contains or is amended to contain a specific reference to the provisional application.

(2) A provisional application filed under section 111(b) of this title may not be relied upon in any proceeding in the Patent and Trademark Office unless the fee set forth in subparagraph (A) or (C) of section 41(a)(1) of this title has been paid and the provisional application was pending on the filing date of the application for patent under section 111(a) or section 363 of this title.

Title 35, United States Code §120

SECTION 120. BENEFIT OF EARLIER FILING DATE IN THE UNITED STATES

An application for patent for an invention disclosed in the manner provided by the first paragraph of section 112 of this title in an application previously filed in the United States, or as provided by section 363 of this title, which is filed by an inventor or inventors named in the previously filed application shall have the same effect, as to such invention, as though filed on the date of the prior application, if filed before the patenting or abandonment of or termination of proceedings on the first application or on an application similarly entitled to the benefit of the filing date of the first application and if it contains or is amended to contain a specific reference to the earlier filed application.

Title 35, United States Code §365

SECTION 365. RIGHT OF PRIORITY; BENEFIT OF THE FILING DATE OF A PRIOR APPLICATION

(a) In accordance with the conditions and requirements of subsections (a) and (d) of section 119 of this title, a national application shall be entitled to the right of priority based on a prior filed international application which designated at least one country other than the United States.

(b) In accordance with the conditions and requirements of this section 119(a) of this title and the treaty and the Regulations, an international application designating the United States shall be entitled to the right of priority based on a prior foreign application, or a prior international application designating at least one country other than the United States.

(c) In accordance with the conditions and requirements of section 120 of this title, an international application designating the United States shall be entitled to the benefit of the filing date of a prior national application or a prior international application designating the United States, and a national application shall be entitled to the benefit of the filing date of a prior international application designating the United States. If any claim for the benefit of an earlier filing date is based on a prior international application which designated but did not originate in the United States, the Commissioner may require the filing in the Patent and Trademark Office of a certified copy of such application together with a translation thereof into the English language, if it was filed in another language.

Title 37, Code of Federal Regulations, §1.56

SECTION 1.56. DUTY TO DISCLOSE INFORMATION MATERIAL TO PATENTABILITY

(a) A patent by its very nature is affected with a public interest. The public interest is best served, and the most effective patent examination occurs when, at the time an application is being examined, the Office is aware of and evaluates the teachings of all information material to patentability. Each individual associated with the filing and prosecution of a patent application has a duty of candor and good faith in dealing with the Office, which includes a duty to disclose to the Office all information known to that individual to be material to patentability as defined in this section. The duty to disclose information exists with respect to each pending claim until the claim is cancelled or withdrawn from consideration, or the application becomes abandoned. Information material to the patentability of a claim that is cancelled or withdrawn from consideration need not be submitted if the information is not material to the patentability of any claim remaining under consideration in the application. There is no duty to submit information which is not material to the patentability of any existing claim. The duty to disclose all information known to be material to patentability is deemed to be satisfied if all information known to be material to patentability of any claim issued in a patent was cited by the Office or submitted to the Office in the manner prescribed by §§1.97(b)-(d) and 1.98.* However, no patent will be granted on an application in connection with which fraud on the Office was practiced or attempted or the duty of disclosure was violated through bad faith or intentional misconduct. The Office encourages applicants to carefully examine:

(1) prior art cited in search reports of a foreign patent office in a counterpart application, and

(2) the closest information over which individuals associated with the filing or prosecution of a patent application believe any pending claim patentably defines, to make sure that any material information contained therein is disclosed to the Office.

(b) Under this section, information is material to patentability when it is not cumulative to information already of record or being made of record in the application, and

(1) It establishes, by itself or in combination with other information, a prima facie case of unpatentability of a claim; or

(2) It refutes, or is inconsistent with, a position the applicant takes in:

(i) Opposing an argument of unpatentability relied on by the Office; or

(ii) Asserting an argument of patentability.

A prima facie case of unpatentability is established when the information compels a conclusion that a claim is unpatentable under the preponderance of evidence, burden-of-proof standard, giving each term in the claim its broadest reasonable construction consistent with the specification, and before any consideration is given to evidence which may be submitted in an attempt to establish a contrary conclusion of patentability.

(c) Individuals associated with the filing or prosecution of a patent application within the meaning of this section are:

(1) Each inventor named in the application;

(2) Each attorney or agent who prepares or prosecutes the application; and

(3) Every other person who is substantively involved in the preparation or prosecution of the application and who is associated with the inventor, with the assignee or with anyone to whom there is an obligation to assign the application.

(d) Individuals other than the attorney, agent or inventor may comply with this section by disclosing information to the attorney, agent, or inventor.

* §§1.97(b)-(d) and 1.98 relate to the timing and manner in which information is to be submitted to the Office.